Benchmarking: An International Journal

Measuring retail supply chain performance: Theoretical model using key performance indicators (KPIs)

Neeraj Anand Neha Grover

Measuring retail supply chain performance

Theoretical model using key performance indicators (KPIs)

Neeraj Anand and Neha Grover
College of Management and Economics Studies (LSCM), University of Petroleum and Energy Studies, Dehradun, India

Received 21 May 2012
Revised 12 December 2012
19 February 2013
Accepted 22 February 2013

Abstract

Purpose – A growing body of literature has begun in the direction of supply chain performance measurement. However, selecting the appropriate set of key performance indicators (KPIs) for measuring supply chain performance have always remained a challenge. The purpose of this paper is to identify the KPIs and categorize them specifically for measuring retail supply chain performance.
Design/methodology/approach – A qualitative approach, based on literature has been adopted. Published literature from refereed journals on supply chain performance measurement has been considered and various approaches for developing KPIs have been studied to develop a theoretical framework for performance measurement in retail supply chain.
Findings – The paper identifies key indicators for performance measurement and classifies them into four major categories: transport optimization, information technology optimization, inventory optimization and resource optimization. These key indicators are arranged precisely for retail industry. A theoretical framework is proposed to link the performance of these constructs on financial performance of the firm.
Research limitations/implications – Future research can be carried out to validate the relevance and applicability of identified indicators. The study can be further conducted to measure the interrelationships between the KPIs and their impact on financial performance of the firm.
Practical implications – This study proposes a list of indicators for retail industry, which are presented in appropriate categories so that it can be used by the focussed teams for further improvement.
Originality/value – To the best of authors' knowledge, no other study has categorized the KPIs into groups, specifically for measuring retail supply chain performance. The researcher also intends to carry out further empirical study to test the proposed theoretical framework.

Keywords Inventory optimization, Supply chain performance measurement, Information technology optimization, Resource optimization, Return on assets, Transport optimization
Paper type Literature review

Introduction

Supply chain management (SCM) has become a key management focus and the source of competitive advantage for many firms. Companies in the retail industry implementing SCM aim to react to the increasing uncertainty and complexity of the business environment, to advance their competitive position in the entire value chain. To establish a clear picture of how the retail supply chain performs the dimensions of performance should include both financial performance and non-financial performance. Globalization, market instability, reducing product life-cycles and ever increasing competition are some of the major convincing factors which are compelling companies to focus on their core competencies and outsource an increasing amount of their other nonvalue-adding activities (Prahalad and Krishnan, 2008; Gunasekaran *et al.*, 2001; Prahalad and Hamel, 1990). Moreover, today the competition has shifted from products to supply chains (Lambert and Cooper, 2000; Bradley *et al.*, 1999; Christopher, 1998, 1992; Cox, 1999a; Bowersox, 1997).

Benchmarking: An International Journal
Vol. 22 No. 1, 2015
pp. 135-166

1463-5771
DOI 10.1108/BIJ-05-2012-0034

Under such circumstances, in order to ensure growth, the retail supply chain must be adaptive and responsive (Ramesh *et al.*, 2008). Adaptive supply chains or supply networks are those that are flexible enough to meet the demand of changing customer markets. An adaptive supply chain requires greater collaboration and visibility between all points within the supply chain and all its extensions. The impact of SCM extends beyond reducing costs (Farris II and Hutchison, 2002; Ellram and Liu, 2002; Lambert and Cooper, 2000), and it has been suggested that excellence in managing supply chains is directly linked to superior organizational performance (Christopher, 2005; D'Avanzo *et al.*, 2004; Ellram *et al.*, 2004). Performance measures are critical to achieve these tasks. According to Gunasekran *et al.* (2001), performance measures in a supply chain are required "to streamline the flow of material, information, and cash, simplify the decision-making procedures, and eliminate non-value adding activities." It has been pointed out that after the balanced scorecard approach; there has been no significant contribution (Sambasivan, *et al.*, 2009). Therefore, research in performance measurement holds a promising future and much is required to be done. Measurement enables organizations to benchmark their current levels of practice against the best-in-class performers. To achieve better supply chain performance (such as complete order fill, accurate and timely information, reliable and short order cycle time), Ellram *et al.* (1999) suggested that retailers need to establish closer relationships with supply chain partners.

As it has been rightly pointed out by Lord Kelvin that, "If you cannot measure it, you cannot improve it." One has to set benchmark in order to fulfill long term objectives. In this era of globalization the organizations have realized that supply chain excellence is the ultimate source of competitive advantage and today the competition is not among the products but between one supply chains to another. With the advent of internet, the way of doing business has changed to e-business and hence the multiple partners of supply chain across the globe are integrated with real time information. It is a significant challenge to measure supply chain performance at each point of these dynamic interactions. The system requires a better trade-off between cost and service in order to achieve the benefits of economies of scale and economies of scope, thus maximizing the service and return on assets (ROA). SCM, investigation, and further development are becoming increasingly significant. According to some authors (Ganesan *et al.*, 2009; Brown and Dant, 2008), SCM is in fact vital for retail success.

Moreover, improving performance of a supply chain is a continuous method that necessitates logical performance measurement system, and develops an instrument for comprehending key performance indicators (KPI) objectives; which relates planning and implementation of performance objectives into daily routine work. Furthermore (Neely (1999) gives several reasons for growing importance of performance measurement and being a key agenda of management, like the varying environment of work; growing competition; various development incentives; national and international quality awards; shifting organizational responsibilities; changes in external demand; and the influence of advancements in information technology.

A typical firm already has a certain number of KPIs such as return on investment (ROI) for assessing its financial performance, but supply chain related KPIs have not been widely adopted and businesses are typically uninformed of them. Companies often find that there is a lack of practical guidelines on how to develop KPIs. This seems to be in contrast to the fast adoption of various SCM related technologies and other best practices for the past decade. The performance metrics or KPIs offer the overall visibility of supply chain and help to assess the accuracy of supply/demand

plan (e.g. forecast accuracy), and the execution performance (e.g. actual sales vs forecast plan). Framework for supply chain performance measurement comprising of KPIs may be seen as a representative set of measures, and logically establish interrelationships among those measures. These KPIs comprise a set of both financial and non-financial measures (Gopal and Thakkar, 2012).

Scope and objective of the paper

This paper presents a review of the available literature on performance measurement showcasing the importance of measuring supply chain performance and developing a theoretical framework with the identified KPIs for retail supply chain. It has been seen that there are many dimensions to measure and no single measure defines supply chain performance. Thus, there is a need to obtain balance throughout the supply chain and the preparedness to change for better results. In this environment of dynamic supply chain, continuous improvement in supply chain performance has become a key concern for the supply chain partners, like suppliers, manufacturers, and the associated retailers for continuous business growth. A set of variables that signify the impact of real working of the supply chains based on the profitability of the entire system are used to measure supply chain performance (Ramdas and Spekman, 2000). These variables are key drivers of supply chain which are obtained from business practices. Once the measures for supply chain performance are recognized effectively, managers have to classify the important KPIs for further improvement. Retailers face many challenges in the ever increasing fierce competition. With the increase in product variety, increasing uncertainty in demand and supply, the need to reduce the time to market, shorter and shorter product life cycle with greater efficiency has raised the benchmark for the retailers to deliver value to the customers. As a consequence of the ability that comes with control over consumer relations, retailers today have the ability to organize their supply chains functions in suitable ways. Identification of KPIs for measuring the retail supply chain performance can offer an overall visibility about the functioning of supply chain and can help managers to identify the key areas of improvement, whose impact can be seen on the financial performance of the firm.

Most of the occasions, the existing measurement system is static in nature and it often lags behind the continuously changing contexts in supply chains. It is observed that in dynamic environment of supply chain, a number of measures get non-operational and yet remain embedded, particularly some of the present KPIs. Thus the companies have problems in outlining their continuously changing strategic objectives and meet the needs of the dynamic decision-making environment. From a systems viewpoint, feedback is necessary for the continuous growth of the organization. Performance measures or KPIs helps in assessing the overall visibility of supply chain processes which further assist in estimating the accuracy of supply/ demand plan. In the light of above discussion, the objectives of this paper are to:

(1) identify KPIs for measuring retail supply chain performance; and

(2) to develop a theoretical framework linking the performance of identified KPIs on financial performance of the firm.

Thus, the remaining of the paper is organized as follows. Importance of measuring supply-chain performance incorporating various insights, categorizing KPIs and summarizing the various approaches for developing KPIs. Thereafter, the identified KPIs are listed in a tabular form followed by performance measurement in retail supply chain. Finally the theoretical framework is proposed.

Importance of measuring supply chain performance

In recent years, organizations have realized the potentials of SCM. Nevertheless, they lack insight for the development of effective performance measures and metrics, required to achieve a fully integrated supply chain. Despite of SCM performance importance, putting performance measurement in place has always been a difficult task. Developing a performance measurement tool set (also known as KPIs or metrics) involves a rather complicated process and can be very challenging for ordinary businesses because of lack of incentives and top management support, an organizational culture unfavorable to implement performance measurement system (Aramyan *et al.*, 2007; Shepherd and Gunter, 2006; Chan and Qi, 2003; Lambert and Pohlen, 2001; Lapide, 2000). The following points facilitate in defining the significant role of strategic thinking behind successful implementation of performance measurement, role of KPIs in visibility of entire supply chain performance and the importance of collaborative approach in measuring performance:

(1) Authors draw the attention to the role of senior management team in measuring supply chain performance for making strategic decisions as shown in Table I. It is essential to have the support of the management as well an organizational culture to support the development of performance measurement tool consisting of selectively chosen set of appropriate KPIs (Aramyan *et al.*, 2007; Shepherd and Gunter, 2006; Chan and Qi, 2003; Lambert and Pohlen, 2001; Lapide, 2000). Furthermore, performance measurement or monitoring plays the role of feedback in one's supply chain. A number of companies have very little understanding of how to define KPIs for their supply/demand chain. Several of the characteristics presented by (Beamon, 1996) for performance measurement systems include: inclusiveness (measurement of all pertinent aspects), universality (allow for comparison under various operating conditions), measurability (data required are measurable), and consistency (measures consistent with organization goals).

(2) Authors highlight the role of KPIs in visibility of entire supply chain performance, as shown in Table II. Logically, performance management in supply chain is about setting objectives for the supply chain functions that will direct to the desired results with agreement. It was also stated that performance metrics can define the performance objectives in an explicit and quantifiable manner

Table I. Strategic importance of performance measurement

Author (year)	Research contribution	Inference
Davis and Albright (2004)	Author asserts that performance measurement through the establishment of KPIs helps the senior management team to make important strategic decisions	Strategic importance of performance measurement
Kincaid (1994)	Author mentions that performance measurement is essential – particularly in order to perform comparisons and develop strategies for improvements	
Lebas (1995)	Author argues that looking into the past, the present and the future to drive performance improvement decision-making strategies is one prime reason why one should execute performance measurement	

Author (year)	Research Contribution	Inference
Chen *et al.* (2004)	Measuring supply chain performance can facilitate a greater understanding of the supply chain, positively influence actors' behaviour, and improve its overall performance	Importance of measuring supply chain performance for clear visibility of actors involved in it
Baldwin *et al.* (2000)	Performance metrics indicate long- and short-term finance and performance-related goals, and are vital for a healthier relationship between the customer and the provider of services	
Chae (2009)	Performance metrics or KPIs off er the overall visibility of supply chain and help to assess the accuracy of supply/ demand plan (e.g. forecast accuracy), and the execution performance (e.g. actual sales versus forecast plan)	

Table II. Visibility of performance in supply chain activities

(Hitchcock, 2002; O'Sullivan *et al.*, 2004). Performance Measurement tools have been extensively adopted by companies to support the supply chain strategies in which performance measures are critical to achieve the desired tasks. As mentioned earlier that performance measures in a supply chain are required "to streamline the flow of material, information, and cash, simplify the decision-making procedures, and eliminate non-value adding activities" (Gunasekaran *et al.*, 2001). Therefore, selection of performance measurement system is a crucial step in design and evaluation of a supply chain process. Thus such measures and metrics are needed to test and reveal the viability for directing toward realization of goals and improvement of supply chain strategies.

(3) Authors pointed out the importance of collaborative efforts involved in measuring supply chain performance as shown in Table III. Most of the companies while

Author (year)	Research contribution	Inference
Ireland and Crum (2005)	Top management decides cross-functional activities and involvement of various departments in collaboration at functional/operational and strategic level. Performance at this stage of collaboration is measured through operational efficiency and risk/return ratio	Collaborative approach involving all the departments performance metrics to relate to the organizational towards performance measurement
Stank *et al.* (2005) and Rowat (2006)	Authors attempted to relate internal and external collaboration with logistical service performance	
Ho *et al.* (2000)	Author states that performance metrics represent indicators of performance that can be used for a genuine comparison within and between organizations. Performance metrics provide an essential common platform for comparison, based on which improvements can be sought for any individual indicator	

Table III. Importance of collaborative approach in SC performance

gathering suggestions and inputs from employees and consultants keep adding measures and fail to realize that small set of measures can address the supply chain performance. It has been pointed out that while financial performance measurements are important for strategic decisions and external reporting, day-to-day control operational activities like inventory management and distribution are better handled by non-financial measures. The role of people is important for measuring the actual performance and a collaborative approach necessitates it further.

Cost as a single supply chain performance measure

Performance measurement has been defined and redefined over the years. It has its roots in early accounting system in the late thirteenth century, when traders used it to settle their transactions. After the industrial revolution, till late twentieth century, financial measures of performance were used. The traditional financial measures laid emphasis on local departmental performance and were internally focussed rather than focussing on overall health or performance of the business (Neely *et al.*, 1995; Keegan *et al.*, 1989; Johnson and Kaplan, 1987). Changes in global economy made businesses realize that in order to be successful they have to focus on their business strategy, which caused a shift in focus from production or cost oriented approach to a more strategic approach. During this shift, a number of frameworks were developed, which addressed to the shortcomings of traditional financial accounting systems. These frameworks provided different perspectives for categorizing performance measures with their own limitations, likewise they do not tell what to measure with the given objective of the business. Even though, many companies have realized the importance of both financial and non-financial performance measures, they have failed to understand them in a balanced framework. There has been an inequality in the selection of metrics between financial and operational measures which does not lead to metrics that can present a clear picture of the organizational performance (Kaplan and Norton, 1992). It has been pointed out that while financial performance measurements are important for strategic decisions and external reporting, day-to-day control of manufacturing and distribution operations is better handled by non-financial measures (Maskell, 1991). Moreover, during the last two decades performance measurement has gained great interest (Taticchi *et al.*, 2010). Authors have developed various approaches for categorizing KPIs or performance measures into different groups, as discussed in the subsequent sections.

Categorizing KPIs

A number of performance measurement tools have been identified in which the indicators have been categorized into various groups. As discussed by (Neely *et al.*, 1995), numerous approaches were developed for performance measurement model, includes: balanced scorecard (Kaplan and Norton, 1992); performance measurement matrix (Keegan *et al.*, 1989); performance measurement questionnaires (Dixon *et al.*, 1990); criteria for measurement system design (Globerson, 1985); supply chain operations reference (SCOR) model (Supply Chain Council, 1996) and, computer aided manufacturing approaches. Likewise, the authors have highlighted a range of limitations of existing measurement systems including: they encourage short termism; they lack strategic focus (the measurement system is not aligned correctly with strategic goals, organization culture or reward systems); they encourage local optimization by forcing managers to minimize the variances from standard, rather than seek to improve

continually; and, they fail to provide adequate information on what competitors are doing through benchmarking. For the proposed performance metrics to work properly, among other things such as systems, master data, and processes (Yang and Chen, 2006), the roles and responsibilities (R&R) of organizational members and units or teams need to be clearly defined and communicated enterprise-wide on a regular basis. There have been different methods for categorizing KPIs as per the need of the system so that t can be easily monitored.

Various metrics used in supply chain performance assessment have been designed to measure operational performance, to assess enhanced efficiency and to review strategic alignment of the entire SCM. Performance measurement or monitoring conducts the job of feedback in better functioning of supply chain activities. Companies usually have modest understanding of how to classify KPIs for their supply chain and lay down the structure of people's R&R applicable to performance measurement system. Developing KPIs is not an easy job, listing potential supply chain related KPIs itself appears to be so vast that it becomes inexhaustible to classify all the performance indicators (Shepherd and Gunter, 2006; Hoffman, 2004; Gunasekaran *et al.*, 2001; Lapide, 2000). Unlike a common insight that "more is better," in supply chain performance measurement is rather the other way that "less is better," therefore the companies should basically begin assessment with a small number of KPIs. In addition, companies can take advantage from those few selected KPIs and streamline the processes accordingly. There are numerous potential approaches to do so. Authors have classified KPIs into different levels depending upon the hierarchy in management of process. Likewise Hoffman (2004), categorized KPIs as top tier, mid-level, and ground level; or performance measurement systems have been analyzed at three levels: the individual metrics; the set of measures, or performance measurement system as an entity; and, the relationship between the measurement system and the internal and external environment in which it operates (Neely *et al.*, 1995). A set of metrics developed by Gunasekaran *et al.* (2001) has been classified into strategic, tactical and operational levels of supply chain. Several of these metrics are segmented into financial and non-financial measures. Huang *et al.* (2005) further categorized the KPIs at three levels – strategic (e.g. total cycle time), tactical (e.g. delivery reliability), and operational (e.g. capacity utilization). Individual measures of supply chain performance have typically been categorized into four groups: quality, time, cost, flexibility. Furthermore, the measures have been classified as quality and quantity, cost and non-cost, strategic/operational/tactical supply chain processes (Shepherd and Gunter, 2006; Gunasekarana *et al.*, 2004). The KPIs which were categorized as cost-related and non-cost-related were sorted in separate groups of financial and non-financial. All cost-related indicators under a separate category called "financial" and all non-cost related indicators as "non-financial." Subsequently Chae (2009) categorized KPIs as primary and secondary. The primary metrics (e.g. forecast accuracy, on time delivery) represent a company's overall supply chain performance. The secondary metrics are potential indicators of why the primary metrics are high or low and offer a detailed view of supply chain.

In logistics, Van der Vorst (2000), makes a distinction between performance indicators on three main levels: first the supply chain level (e.g. product availability, quality, responsiveness, delivery reliability and total supply chain; second, the organization level (e.g. inventory level, throughput time, responsiveness, delivery reliability and total organizational costs); and third the process level (e.g. responsiveness, throughput time, process yield and process costs). In manufacturing, Li and O'Brien (1999) proposed a model to improve supply chain efficiency and effectiveness based on four criteria: first, profit;

second, lead-time performance; third, delivery promptness; and fourth, waste elimination. Lai *et al.* (2002) distinguished three dimensions of supply chain performance in transport logistics: first, service effectiveness for shippers; second, Operational efficiency; and third, service effectiveness for consignees.

A number of the studies which were conducted in the context of facility management or environmental performance measurement classified the KPIs into groups like energy, environment, etc. Similarly, Augenbroe and Park (2005) characterized the indicators as energy, lighting, thermal comfort and maintenance in context to facility management. Hinks and McNay (1999) characterized the KPIs as business benefits, equipment, space, environment, change, maintenance/services, consultancy and general. With span of time, besides the usual financial terms, the customer relations and internal business growth were also given importance. Amaratunga and Baldry (2003), categorized the KPIs according to four basic principles such as customer relations, financial management internal processes, learning and growth, and financial implications. Further analysis of the KPIs revealed that numerous indicators represent operational performance of a facility or organization; these were then regrouped under either "functional" or "physical," based on their scope and intent. Those KPIs found to be unquantifiable or based on subjective opinions were grouped as "survey-based" KPIs (Lavy *et al.*, 2010; Gumbus, 2005; Augenbroe and Park, 2005; Amaratunga and Baldry, 2003; Ho *et al.*, 2000; Hinks and McNay, 1999; Douglas, 1996).

Over a period, flexibility has gained importance not only in manufacturing but also in other aspects of supply chain and it has been identified as a key variable influential in measuring supply chain performance. Flexibility is a very general concept that is often viewed as a firm's ability to match production to market demand in the face of uncertainty and variability. The notion of flexibility is closely linked to the firm's ability to provide niche and customized products to the consumer. Therefore, there is a need to look at a wider perspective of supply chain that includes activities like logistics, sourcing, information flexibility, etc. besides the manufacturing activity. Subsequently, some of the authors distinguished measures between cost and non-cost measures (time, quality, flexibility, and innovativeness) (Angerhofer and Angelides, 2006; Shepherd and Gunter, 2006; Gunasekarana *et al.*, 2004; Bolstorff, 2003; Beamon, 1999). Similarly, Chan and Qi (2003) categorized measures as cost, quality, resource utilization, flexibility, visibility, trust, and innovativeness. Within the agility literature, flexibility and innovativeness are considered to be important strategic drivers of supply chain development in the future (Chen *et al.*, 2004; Gunasekaran *et al.*, 2001; De Toni and Tonchia, 2001).

The importance of collaborative efforts have already been mentioned earlier (Ireland and Crum, 2005; Stank *et al.*, 2005; Ho *et al.*, 2000). Author Hieber (2002) categorized KPIs as Supply chain collaboration efficiency; coordination efficiency and configuration. The summary of categorization of KPIs is shown in Table IV.

Approaches for categorizing KPIs

The important contribution by many researchers is on emphasizing the need for adopting a systemic approach to performance measurement. For example, modern manufacturing practices such as quality management (Flynn and Flynn, 2005), just-in-time (Green *et al.*, 2008) and information technology (Dyapur and Patnaik, 2005) effects the overall supply chain performance. It has been observed that the performance indicators have been categorized into various categories and different approaches have been adopted likewise, BSC, SCOR, etc. Decision modeling techniques

Author (year)	Categorization of KPIs
Hoffman (2004)	As top tier, mid-level, and ground level
Neely *et al.* (1995)	At three levels: the individual metrics; the set of measures, or performance measurement system as an entity; and, the relationship between the measurement system and the internal and external environment in which it operates
Huang *et al.* (2005), Gunasekaran *et al.* (2001)	In three levels – strategic, tactical and operational
Shepherd and Gunter (2006), Gunasekarana *et al.* (2004)	As quality and quantity, cost and non-cost, strategic/operational/tactical focus, and supply chain processes
Chae (2009)	As primary and secondary indictors
Augenbroe and Park (2005)	Grouped into energy, lighting, thermal comfort and maintenance
Hinks and McNay (1999)	Classified KPIs into business benefits, equipment, space, environment, change, maintenance/services, consultancy and general
Amaratunga and Baldry (2003)	Classified KPIs into customer relations, FM internal processes, learning and growth, and financial implications
Lavy *et al.* (2010), Gumbus (2005), Augenbroe and Park (2005), Amaratunga and Baldry (2003), Ho *et al.* (2000), Hinks and McNay (1999), Douglas (1996)	As cost-related and non-cost-related KPIs
Angerhofer and Angelides (2006), Shepherd and Gunter (2006), Gunasekarana *et al.* (2004), Bolstorff (2003), Beamon (1999)	Grouped KPIs into quality time, cost and flexibility
Chen *et al.* (2004), Gunasekaran *et al.* (2001), De Toni and Tonchia (2001)	As cost and non-cost measures (time, quality, flexibility and innovativeness)
Shepherd and Gunter (2006), Chan and Qi (2003)	Catergorized KPIs as cost, quality, resource utilization, flexibility, visibility, trust and innovativeness
Lee (2004), Morgan (2004)	As flexibility and innovativeness measures
Hieber (2002)	Grouped into collaboration efficiency; coordination efficiency and configuration.
Van der Vorst (2000)	At three main levels: the supply chain level; the organization level; and the process level
Li and O'Brien (1999)	At four levels: profit; lead-time performance; delivery promptness; andwaste elimination
Lai *et al.* (2002)	At three levels: service effectiveness for shippers; operational efficiency; and service effectiveness for consignees
De Toni and Tonchia (2001)	As financial and non-financial
Gunasekaran *et al.* (2001)	As quantitative and non-quantitative
Chopra *et al.* (2007)	Grouped as facilities, transportation, information, inventory, sourcing, and pricing
Chan and Qi (2003)	Grouped into input measures, output measures, and composite measures
Closs and Mollenkopf (2004)	Grouped into customer service, cost management, quality, productivity, and asset management
Agarwal *et al.* (2006)	Grouped into market sensitiveness, information driven, and process integration

Table IV. Summary of Literature for categorization of KPIs

have also been adopted like analytical hierarchy process (AHP), data envelopment analysis (DEA), etc. In 1992, Kaplan and Norton introduced balanced scorecard which includes both financial and non-financial measures. It looks at the business from four perspectives, financial, customer, innovation and learning, and internal processes. It emphasizes on translating the organization's strategy into set of objective for each of business perspective. Performance measurement cannot be executed solely on the basis of one indicator and suggest that the Balanced Scorecard approach provides holistic metrics of KPIs that include indicators relating to customers, internal processes, financial aspects, and innovation (Amaratunga *et al.*, 2000a; Sousa *et al.*, 2006). The SCOR model – has been a popular measurement tool introduced by Supply Chain Council (SCC) in 1996. It has been extensively used to develop supply chain performance metrics. According to SCOR model, a company's supply chain is represented by five meta-level processes of plan, source, make, delivery and return. In practice, this high-level view of SCM processes can also be used for identifying potential KPIs. SCOR Model advocates a set of supply chain performance indicators as a combination of: reliability measures (e.g. fill rate, perfect order fulfillment), cost measures (e.g. cost of goods sold (COGS)); responsiveness measures (e.g. order fulfillment lead-time); and asset measures (e.g. inventories)(Shepherd and Gunter, 2006; Lockamy and McCormack, 2004; Bolstorff, 2003; Neely *et al.*, 1995).

Authors observed that for performance assessment, it is important to identify factors that are crucial to the success of the organization. Furthermore, these factors are referred as critical success factors (CSFs) which indicates the efforts required necessarily to meet organizational goals and it consist of one or more KPIs that help management grasp, evaluate, and govern the progress made by the organization (Atkin and Brooks, 2000). Additionally authors suggested process based division of performance metrics; they differentiated the metrics according to the process in the supply chain they relate to. For example, Chan and Qi (2003) identify six core processes (supplier, inbound logistics, manufacturing, outbound logistics, marketing and sales, end customers) and present input, output and composite measures for each which is similar to the proponents of the SCOR model (Li *et al.*, 2006; Lockamy and McCormack, 2004; Huang *et al.*, 2005).

Decision modeling techniques were also used widely (Li *et al.*, 2006; Huang *et al.*, 2005). Nevertheless, there is a disagreement, whether there is the most appropriate technique for selecting measures. For example, while the use of AHP was advocated, its efficacy has recently been disputed by (Chan and Qi, 2003) who favor fuzzy ratios for selecting measures. DEA can evaluate the performance measures quantitatively and qualitatively. It is based on the idea of efficient frontier analysis. It is not based on average value but takes the best value form the set of data (Talluri and Sarkis, 2001).

Various other approaches discussed as follows.

Theory of constraints (TOC), introduced as a concept of continuous improvement management philosophy. TOC improves performance in a system by focussing attention of management on the system's constraints.

Prioritization of KPIs are also based on SMART criteria (Specific, Measurable, Attainable, Realistic, and Time-sensitive). The proposed approach results in a systematic decision making approach to assist managers in determining which KPIs are more relevant to organizational goals than others (Shahin and Mahbod, 2007).

A multi-attribute decision model (MADM), namely performance value analysis (PVA) aim to assess the performance of supply chain by supplementing decision-making process and setting internal benchmarks (Soni and Kodali, 2009).

Strength, weaknesses, opportunities, and threats (SWOT) analysis has been applied on every driver of each supply chain in comparison to others to identify the strong, weak, and improvement aspects of each supply chain drivers (Soni and Kodali, 2009).

Regression analysis is used to analyze data in performance measurement and benchmarking as well as it provides a good theoretical background to the research by establishing relationship between dependent and independent variables. It thus provides meaningful interpretation of the data and results (Moseng, 1995; Blumberg, 1994; Schefcyzk, 1993).

These approaches have their own limitations with respect to a particular context and they cannot be generalized in all business scenarios. It has been discussed in the later part of the study and then the identified KPIs are grouped specifically for retail supply chain. The summary of approaches for categorizing KPIs has been summarized in Table V.

Gaps in the literature

It is widely acknowledged that there has been relatively little interest in developing measurement systems and metrics for evaluating supply chain performance (Gunasekaran *et al.*, 2001; Beamon, 1999) Chen *et al.* (2004) and others (Fynes and Voss, 2005; Ellinger, 2000); found it encouraging that researchers have developed measures to assess the performance of supply chain relationships or the performance of a supply chain as a whole A typical firm already has a certain number of KPIs such a ROI for assessing its financial performance, but supply chain related KPIs have not been widely adopted and businesses are typically uninformed of them (Chae, 2009). Also, the Traditional BSC and SCOR models generally assume that KPIs are uncoupled. These approaches could describe business operations well, and serve as a good communication tool, but they are not effective in improving overall performance by accomplishing the critical KPIs (Cai *et al.*, 2009). As pointed out by (Douglas, 1996; Ho *et al.*, 2000; Gumbus, 2005), that categorization must provide the organizations an opportunity to select the performance indicators in which the companies are most interested. However Lambert and Pohlen (2001) observes that one of the main problems with supply chain metrics is that "they are, in actuality, about internal logistics performance measures" and do not capture how the supply chain as a whole has

Author, Year	Approach
Amaratunga *et al.* (2000a), Sousa *et al.* (2006)	Balanced scorecard approach
Lockamy III and McCormack (2004), Shepherd and Gunter (2006), Bolstorff (2003), Neely *et al.* (1995)	SCOR approach based on five processes
Atkin and Brooks (2000)	Critical success factors (CSFs)
Chan and Qi (2003), Huang *et al.* (2005), Li *et al.* (2006), Lockamy III and McCormack (2004)	Process based division of performance metrics
Li *et al.* (2006), Huang *et al.* (2005)	Analytical hierarchy process (AHP)
Rahman (1998)	Theory of constraints (TOC)
Talluri and Sarkis (2001)	Data envelopment analysis (DEA)
Shahin and Mahbod (2007)	SMART approach
Soni and Kodali (2009)	A multi-attribute decision model (MADM), namely performance value analysis (PVA)
Soni and Kodali (2009)	SWOT analysis
Moseng (1995), Blumberg (1994), Schefcyzk (1993)	Regression analysis

Table V. Summary of literature of approaches developed for categorization of KPIs

performed. For example, although measures such as order fill rate are likely to be influenced by activities throughout the entire supply chain, they ultimately measure performance at the intra, rather than the inter-organizational level. There is a need to incorporate broader relationships such as manufacturers and logistics service providers or distributors to collaborate across different levels of supply chain. One of the concerns that need to be address in this direction includes the integration issue of supply chain in varied industries across the countries. Thus there is a requirement to conduct more empirical studies on the effect of management practices on combination of these SCM practices (Gopal and Thakkar, 2012). To the best of researcher's knowledge no integrated measurement system exists in retail supply chain that combine different aspects of performance (e.g. financial and non-financial, qualitative and quantitative) into one measurement system, therefore, researcher is aiming to propose a theoretical framework for measuring retail supply chain performance, which of course can be further empirically tested to develop a performance management model that can be used by the industry professionals. Table VI provides the list of indicators which were identified through literature review. This list was further used to categorize the KPIs specifically for retail industry.

Research methods

The research method adopted is similar to the concept of exploration through literature as proposed by Swanson (1982) which lay importance to the creation of new information by referring to literature available in the form of peer-reviewed papers, conference proceedings, and other sources of library research, database. Reputed journals were referred from database of Emerald, Science Direct and Ebsco Host: *Journal of Retailing*; *Benchmarking: An International Journal*; *Supply Chain Management: An International Journal*, *International Journal of Retail & Distribution Management*; *International Journal of Productivity and Performance Management*; *Journal of Enterprise Information Management*; *International Journal of Logistics Management*; *Facilities; Journal of Business & Industrial Marketing*; *International Journal of Operations & Production Management*; *Decision Support Systems*, *Journal of Operations Management*, and so on. This approach of literature survey is gaining wider acceptance and it is being used in large number of research studies (e.g. Lavy *et al.*, 2010).

The secondary data were collected through an extensive literature survey that included published books, articles in peer-reviewed journals and conference proceedings, reports on retail industry (KPMG, PwC, FICCI, and others) were referred. The literature was studied in terms of understanding the need and significance of performance measurement, methods of categorizing KPIs and approaches developed for categorizing these KPIs (e.g. BSC, SCOR). The initial list of KPIs was collected and sorted into one of four major categories: transport optimization, information technology optimization, inventory optimization and resource optimization. The four categories are discussed as below:

(1) Indicators like delivery rate, shipping errors, capacity utilization, etc. are included in transport optimization. It incorporated all those indicators which were in reference to transportation of goods at right time and in right condition. The indicators in transport optimization are further categorized into four groups: delivery related performance indicators, time related performance indicators, frequency related performance indicators and capacity related performance indicators.

Author (year)	Performance metrics	Context
Akkermans *et al.* (1999) and SCC – SCOR model	Business strategies (functional capabilities), processes (operational efficiencies), stake holders view (risk/return ratio)	SCOR model-(plan, source, make, deliver)
Aviv (2007), Kim and Oh (2005), Simatupang and Sridharan (2004)	Order of dominance and decision Sharing	Collaborative planning and production, decision making
Emmet and Crocker (2006), Dong and Chen (2005), Lambert and Cooper (2000), Beamon (1999)	Cost, profit, excess inventory, stock-out, resource measure	Collaborative planning and production, decision making
Chae (2009), Chang *et al.* (2007), Forslund and Jonsson (2007), McCarthy and Golicic (2002), Raghunathan (2001)	Impact of information quality on forecasting	Information sharing, forecasting decision making
Forme *et al.* (2007), Angerhofer and Angelides (2006), Barratt and Oliveira (2001)	Reliability, reactivity/flexibility	Information sharing, Forecasting decision making
Aviv (2007), Simchi-Levi and Zhao (2005), Chen *et al.* (2004), Cachon (2001)	Inventory and stock position, stock out, lead time, internal service rate, cross-functional capability, logistics efficiency	Replenishment, decision making
Chae (2009)	Cash to cash cycle, inventory days, planning cycle, supplier fill rate, automatic PO rate	Operations strategy
Cohen and Moon (1990), Lee and Feitzinger (1995), Pyke and Cohen (1993), Pyke and Cohen (1994)	Cost	Resource metrics
Arntzen *et al.* (1995)	Cost and activity time	Resource metrics
Altiok and Raghav (1995), Christy and Grout (1994), Davis (1993), Ishii *et al.* (1988), Newhart *et al.* (1993)	Cost and customer responsiveness	Resource metrics
Lee and Billington (1993)	Customer responsiveness	Output metrics
Cai *et al.* (2009), Angerhofer and Angelides (2006), Van der Vorst (2000)	Information accuracy, Information availability, Information timeliness, Information sharing	Information metrics
Cai *et al.* (2009)	Rates of sales in new products, supply chain stability, number of new products launched, process improvement	Innovativeness metrics
Cai *et al.* (2009)	Manufacturing/production flexibility, new products flexibility, supply chain responsiveness, delivery flexibility, procurement flexibility, information systems flexibility, logistics flexibility	Flexibility

(*continued*)

Table VI.
List of Metrics for supply chain performance measurement

Author (year)	Performance metrics	Context
Cai *et al.* (2009)	Sales (or profit), percent of on-time deliveries, rate of stockouts (losing sales), perfect of order-fulfillment, fill rate (target fill rate achievement, average item fill rate), customer satisfaction, order fulfillment lead time, rates of customer complaints, planned process cycle time, cash to cash cycle time	Output metrics
Cai *et al.* (2009), Shepherd and Gunter (2006), Bolstorff (2003), Chan and Qi (2003), Beamon (1999)	Total supply chain management cost, information management costs, distribution costs, value-added employee productivity, inventory costs, warranty costs, manufacturing costs, return on investment (or ratio of net profits to total assets)	Resource metrics
Voudouris (1996)	Flexibility	Flexibility metrics
Chia *et al.* (2009), Christopher (1994)	Customer satisfaction	Output metrics
Nicoll (1994)	Information flow	Information metrics
Davis (1993)	Supplier performance	Output metrics
Johnson and Randolph (1995)	Risk management	Output metrics

Table VI.

(2) Indicators related to sharing of accurate/reliable information through POS, EDI are included in information technology optimization. These indicators are further categorized into four groups: level of IT implementation related performance indicators, service related performance indicators, responsiveness related performance indicators and cost related performance indicators.

(3) Indicators related to fill rate, stock cover, maintenance of warehouse, etc. are included in inventory optimization. The indicators are further categorized into four groups: cost related performance indicators, time related performance indicators, quantity related performance indicators, and service related performance indicators.

(4) Indicators related to manufacturing cost, COGS, customer satisfaction, etc. are included in resource optimization. The indicators are further categorized into four groups: cost related performance indicators, service related performance indicators, time related performance indicators, and financial ratios related performance indicators.

Results are presented in Table VIII, where indicators are tabulated in four different categories. A total of 22 indicators are grouped in transport optimization, 22 indicators in information technology optimization, 24 indicators in inventory optimization and 21 indicators in resource optimization. The list of indicators presented in this paper represents the views and perception of the authors as well as the industry representatives who were consulted for the purpose of this study. The opinions of management professionals from industry were obtained by administering a brief survey to eight management professionals in retail. These industry representatives were asked the following two questions:

(1) Do you agree or not agree with proposed categories of KPIs?

(2) Do you agree or not agree that this performance metrics categorization would help in retail supply chain performance?

Contingency theory

Our methodological approach of developing a theoretical framework is based on contingency theory. From a scientific perspective, predictability is a main concern, which occurs not only when researchers identify causal mechanisms that tie action to results, but also when circumstances are described (Christensen and Raynor, 2003). Contingency theory attempts to describe these circumstances, suggesting that no universal set of strategic choices applies to every business situation (Ginsberg and Venkatraman, 1985). Early advocates have indicated that organizations are continuously under pressure for sustaining in the market (Lawrence and Lorsch, 1967). Furthermore it was pointed out that contingency theory can be used for improving the performance of the firm (Hofer, 1975). Thus, typical frameworks in the contingency research tradition would focus on the relationships between the contextual factors and the performance (Ginsberg and Venkatraman, 1985; Schoonhoven, 1981). Empirical evidence address that contingency theory is fairly recent in the SCM literature (Van Donk and Van der Vaart, 2005; Ho *et al.*, 2002). In this study, contingency theory was used to categorize the identified KPIs through literature review into various groups. In the subsequent sections an overview of retail supply chain has been given and based on its key processes, the grouping of KPIs has been done.

Performance measurement in retail supply chain

Tremendous changes have been seen in Global Retail sector. With the increasing sales in retail, companies tend to change their strategies with the changing consumer preferences. To have the right product at the right time and in the right place at all the nodal points of retail supply chain is a huge challenge for retailers. An innovative and flexible approach is more appreciated in the current scenario of changing dynamics in retail industry. In this study, researcher has narrowed down the scope of work to four key areas of retailers initiatives as identified by KPMG (2011), i.e. transport optimization, inventory optimization, information technology optimization and resource optimization. The significance of transport, inventory, information technology and resource has been highlighted in several studies (Gunasekaran *et al.*, 2001; Chia *et al.*, 2009; Rajaguru and Matanda, 2009; Beamon, 1999) and in fact these variables are closely linked to for the success of the supply chain. The importance of each variable has been briefly outlined as follows.

Transport optimization

Bowersox *et al.* (2005) identify logistics as "one of the largest costs involved in international trade." Both incorporate performance metrics such as customer satisfaction, delivery speed, delivery dependability, and delivery flexibility Bowersox *et al.* (2005). The logistics performance construct reflects the organization's performance as it relates to its ability to deliver goods and services in the precise quantities and at the precise times required by customers. Authors discuss the importance of a supply chain focus on the part of transport logistics service providers as they function to link suppliers, manufacturers, sellers, and customers throughout the supply chain. They argue that transport logistics service providers must focus on supply chain performance in addition to organizational performance (Lai *et al.*, 2002). Stank *et al.* (2005) and Lin (2006) describe the importance of integrating the logistics processes of all supply chain partners to better serve the needs of ultimate customers.

Inventory optimization

Inventory optimization is one of the integral parts of retail SCM. In the retail sector – specifically stores – there is a relationship between floor space and inventory turns with better performing stores having higher inventory turns per unit area (Raman *et al.*, 2001a). Researchers have focussed mostly on missing inventory, inventory record inaccuracy and inventory replenishment, it is reasonable to suspect that, given the high level of problems with inventories (Raman *et al.*, 2001a; Corsten and Gruen, 2003).

Information technology optimization

Technological developments play an important role in retail operations, in terms of streamlining the flow of goods, services and information. Integrated and coordinated information systems are important to supply chain alignment (Rajaguru and Matanda, 2009). Organizational managers are ultimately held accountable for organizational performance (Walters, 2008; Green *et al.*, 2008). The exchange of information and knowledge is so important that supply chain partners should consider the use of an enterprise planning system to promote the exchange of information and knowledge (Towers and Burnes, 2008). Information sharing results in benefits for all of the supply chain partners. Information and knowledge sharing can help spread the risks, costs, and gains for supply chain partners (Ballou *et al.*, 2000). Organizational success first depends upon the performance of the supply chains in which the organization functions as a partner (Rosenzweig *et al.*, 2003).

Resource optimization

Retailers have to work continuously, not only on optimizing total cost but also the right set of workforce at right place. Efficient retail workforce management focusses on optimizing the workforce by determining the right employee mix while minimizing budget variance (KPMG, 2011). Financial performance focusses on the organization's profitability and ability to generate returns on investment and sales as compared to the industry average Marketing performance focusses on the organization's ability to generate sales as compared to the industry average (Green *et al.*, 2008).

Findings

The study identified the following major indicators for retail supply chain performance in four major categories. Such categorization presents clearly the KPIs critical for each category. The role of each team from strategic to tactical decision making is apparent. Wherein for logistics manager delivery fill rate at optimal cost is important for a high service level, which is the concern for the ultimate strategic decision makers. Such analysis permits the analysis of impacts one indicator on one or more indicators. Likewise percent of on-time deliveries will have an impact on fill rate. Table VII summarizes the responses of short survey of management professionals. All of the professionals agreed on the proper categorization, with few comments for making the study more comprehensive. Overall the study was well appreciated by the management professionals.

Through, literature review numerous variables have been identified for supply chain performance measurement. Here, the performance metrics are discussed which are considered for developing a theoretical framework for retail supply chain. As per Jones and Towill (1997), information flow at all levels of supply chain is critical and specifically the order entry method determines the way and extent to which customer

Respondents	Agree /do not agree with the proposed categorization	Agree/do not agree that the proper categorization would help in retail supply chain performance	Remarks
A	Agree	Agree	GMROF (gross margin return on sft) is another good indicator. One of the concerns in retail is that we need to fill the shelves with stock – empty shelves shows "stock out" or "no option". Even though sales are low, one is compelled to fill the shelves and in turn increase stock cover
B	Agree	Agree	As you know that retail sector is growing very fast, especially in India. every company is coming with an innovation to make their operations smooth and cut down their supply chain cost. Recently Wal-Mart has introduced shipper box to deliver their temperature sensitive product into the ambient vehicle. which is running quite cool and this has dropped down their transportation cost by 50%.we are running this model and if this will be successful then they will implement this in china, and other parts of the world
C	Agree	Agree	–
D	Agree	Agree	ROCE is an important measure. Freshness / ageing of inventory are another very important measure. Full Price sell through of product categories is another key measure in making decisions around what to stock where
E	Agree	Agree	We also look at the line fill rate part along the total fill rate. Potential customer part also be the part of calculation while forecasting of sales and same can derived by checking the daily foot fall for the retail store. Productivity measure in term unit production/ units handled at warehousing level should be taken care off while measuring the performance of retail supply chains
F	Agree	Agree	Manpower productivity (function wise) analysis helps in reducing cost and increasing throughput Man management (minimizing attrition) helps in reducing cost and increasing quality throughput
G	Agree	Agree	–
H	Agree	Agree	Inventory – in retails specially in FMCG […]. need to move out the material within limited time frame as the expiry date as well as local procurement is suggestible

Table VII.
Responses of management professionals on proposed categorization

specification are converted into useful information and channelized across the supply chain partners. With reference to previous studies benefits of information sharing has been found mostly from a modeling/simulation perspective (Bourland *et al.*, 1996; Gavirneni *et al.*, 1999; Ballou *et al.*, 2000; Cachon, 2001; Lee *et al.*, 1997). The important characteristics for information sharing are accurate. Trusted, timely, useful ,and in a readily usable format (Bailey and Pearson, 1983; Gustin *et al.*, 1995; Closs *et al.*, 1997; Whipple *et al.*, 2002). Visibility in information helps to improve supply chain performance (Kulp *et al.*, 2004; Rungtusanatham *et al.*, 2003). In addition, delivery heavily relies on the quality of information exchanged. For example, once the activities are schedules, continuous monitoring of information derived and supplied takes place (Gunasekaran *et al.*, 2001). According to authors Bower and Hout (1988) and Christopher (1992) order cycle time is an important measure for reduction in response time of supply chain and also a source of competitive advantage. Additionally it influences directly the customer satisfaction level (Jones and Towill, 1997) by being more responsive to the customer demand and increasing the delivery reliability and consistency of lead time. Due to fluctuations and uncertainty in the supply chain in handling a large amount of SKUs, a reliable and consistent order lead time reduces the redundancies (Schonberger, 1990). The use of technology and its advances have enforced companies to rearrange the activities of supply chain. The path through which the order travels and spend time in different routes, the non-value adding activities can be identified for elimination. To necessitate this it is important to track and trace the products by use of technology (e.g. e-commerce, EDI, and internet). The entire planning process of making the final order placement has its impact on cost, quality, speed of delivery and delivery reliability and flexibility (Mapes *et al.*, 1997; Slack *et al.*, 1995). As the product range has increased, the value added per employee i.e. productivity of human resource is an important parameter to be considered (Gunasekran *et al.*, 2001). For transport efficiency, the distribution mode, the delivery channel, vehicle scheduling and warehouse location play a significant role and shows tremendous opportunities to improve supply chain performance based on lead-time reduction (Gelders *et al.*, 1994) and it is determined by on-time delivery/perfect delivery parameter which ultimately influences the customer service level (Stewart, 1995).

On the basis of identified KPIs, the authors have further grouped the performance metrics into four categories as follows for the retail supply chains as shown in Table VIII:

(1) transport optimization;

(2) inventory optimization;

(3) information technology optimization; and

(4) resource optimization.

Firm's overall performance

While the importance of SCM is understood, its influence on organizational financial performance is less clear (Frohlich and Westbrook, 2001). LaLonde (2000) argued that the SCM community needed to address an important disconnect between supply chain decisions and financial investment outcomes and Ellram and Liu (2002) also stressed on quantifying the broader impact on SCM. Shah (2009) emphasized that any supply chain initiative that results in an improvement in various aspect of supply chain

Transport optimization	*Inventory optimization*
(A) Delivery related performance indicators	(A) Cost related performance indicators
Delivery schedule adherence	Inventory holding cost as % of gross sales
Percent of on-time deliveries	Inventory carrying cost and warehousing cost
Delivery flexibility	Value of stock-out
Shipping errors	Unit cost per batch (cost/quantity) as in FIFO
No. of claims due to delayed deliveries as % of total revenues	Inventory value
Temperature control during transportation	Stock cover
Delivery promptness	Inventory turnover
Supplier Rejection rate	(B) Time related performance indicators
Last mile connectivity	Customer order promise cycle time
Quality of delivery documentation	% of time spent picking back orders
(B) Time related performance indicators	Inventory replenishment cycle time
Delivery lead time	Perfect order rate
On time ship rate	Order fulfilment cycle time
Product lateness (delivery date – due date)	(C) Quantity related performance indicators
Loading and unloading time from trucks	Obsolete (or left over) value %
On time performance	Inventory accuracy ((book inventory – counted inventory)/book inventory)
(C) Frequency related performance indicators	Number of backorders
Frequency of delivery/ Number of routes on daily basis	Fill rate
Number of road accidents	(D) Service related performance indicators
(D) Capacity related performance indicators	Product flexibility
Capacity utilization (Capacities deployed on all routes)	Number of warehouses
Number of fleet of trucks owned/leased	Number of MHE (material handling equipment) per square feet of warehouse
Capacity of contracted fleet from market	Capacity of the warehouse space/terminal parks
Cargo carried in terms of volumes for fiscal year	Certification of the warehouse (for e.g. ISO certificates)
Fuel consumption (in litres) per tonne-km of cargo carried	Innovation
	Electricity consumption (in Kw-hrs) per sqft of warehouse
	Types of storage facility
Information technology optimization	*Resource optimization*
(A) Level of IT implementation related Performance Indicators	(A) Cost related performance indicators
Level of IT implementation of WMS-module on purchase system/inventory management	Direct labor cost
Level of IT implementation for financial transactions	Direct material cost
Level of IT implementation for track and trace process of goods	Cost of goods sold
Level of integration of multiple decisions (made by retailer company with its channel partners)	Distribution cost
RFID enabled warehouse operations helps in identification of goods with precise details	Inventory cost

(*continued*)

Table VIII. Categorization of KPIs

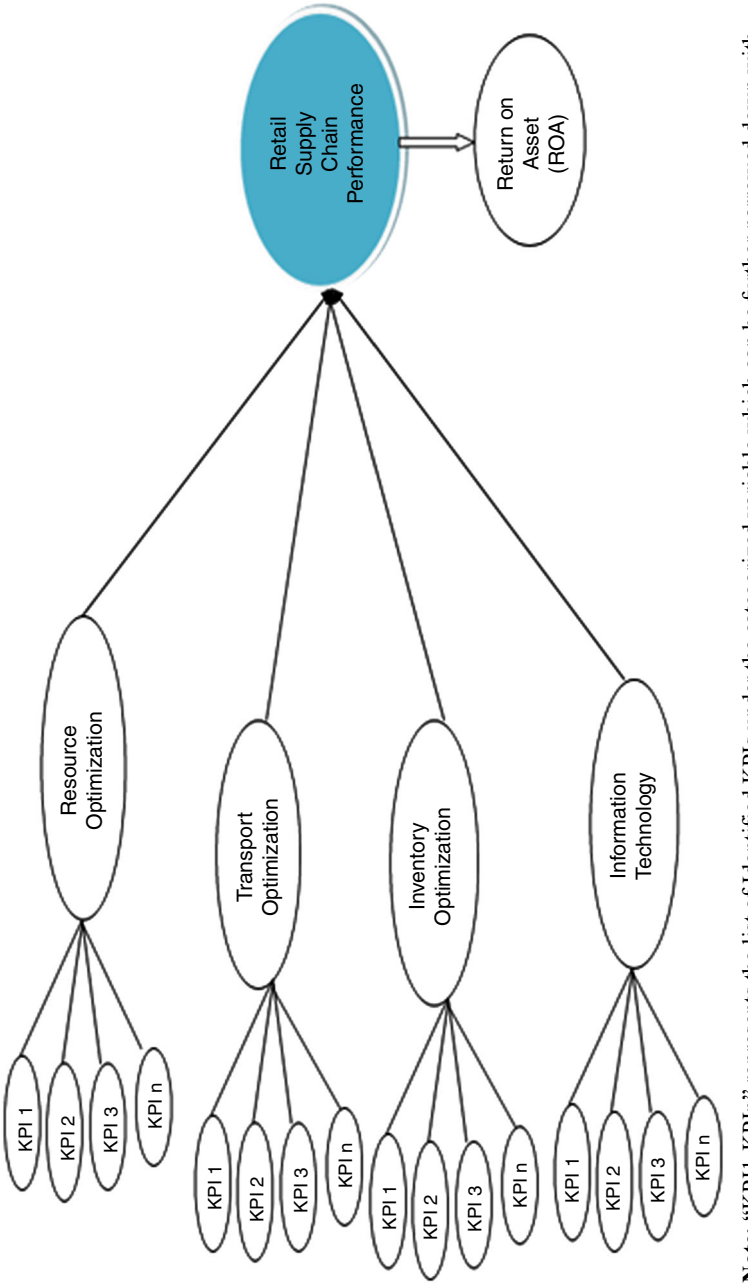
Use of electronic data interchange (EDI) for full IT enablement of all information/data exchanges is important	Manufacturing cost
Point of Sales (POS) data usage helps in replenishing the stock	Information management cost
(B) Service related performance indicators	Warranty cost
Quality of the input data	Packaging cost
Intelligence in setting the logistics parameters in the Re-order system	(B) Service related performance indicators
Information systems flexibility	Quality of packaging material
IT enablement in responding to urgent deliveries	Customer satisfaction
Online booking facilities	Value added employee productivity helps to measure supply chain efficiency
Compliance with latest regulations	(C) Time related performance indicators
(C) Responsiveness related performance indicators	Time taken for training an additional labor is also an important parameter of concern
Number of complaints handled per week	Time required for raising funds for acquiring a new equipment/software/ labour is essential for the supply chain process improvements
Monthly number of complaints vs total number of customers	(D) Financial ratios related performance indicators
Accessibility of real time information	Receivables turnover (annual credit sales/ accounts receivables)
Accuracy and reliability of the acquired information	Average collection period (accounts receivables/(annual credit sales/365))
Sharing of information	Inventory turnover (COGS/average inventory)
(D) Cost related performance indicators	Debt ratio (total debt/total assets)
Transaction cost	Debt-to-equity ratio (total debt/ total equity)
Investment in IT as a percentage of total revenue	Interest coverage (EBIT/interest charges)
Claims (in INR) per month vs monthly turnover	Gross profit margin ((sales−COGS)/sales))
Cost of data maintenance	

Table VIII.

performance must ultimately get translated in to improved business performance. In the final analysis each firm is primarily interested in improving ROA. There are three key areas where SCM can affect an organization's financial performance: profitability, liquidity, and productivity or asset utilization as pointed by Christopher (1998). ROA is a good measure to study the overall impact of the organization's performance. Quantifying supply chain performance using ROA has been identified as an influential indicator (AMR Research, Friscia *et al.*, 2005). The overall impact will be to improve the cash generated in proportion to the assets employed by the organization (Johnson and Templar, 2009). Hence the authors propose the following theoretical framework (Figure 1) for the prospective relationship between KPIs and financial performance using ROA.

Final remarks

The list of indicators presented above is extensive, covering four aspects of retail supply chain: transport optimization, information technology optimization, inventory optimization, and resource optimization. The approach for categorization of KPIs adopted in this paper is new and has not been found in previous literatures. The list of indicators found through literature has been so vast and it raises a common question



Note: "KPI1-KPIn" represents the list of Identified KPIs under the categorized variable which can be further narrowed down with the help of empirical study

Figure 1.
Theoretical framework

for most of the organizations that which indicators are critical for the performance of their organization. Retail supply chain in itself is very dynamic and complex due to the nature of product variants and large SKUs. Transport and inventory management are the most critical part of retail supply chain which are linked with the information sharing at multiple levels for managing their resources. Therefore, keeping the scope of study in mind the categorization of KPIs has been done in these four major categories. Additionally, the indicators grouped in these categories have been further divided into sub categories, likewise, transport optimization is further segmented into delivery, time, frequency, and capacity related performance indicators; inventory optimization is further segmented into cost, time, quantity, and service performance indicators; information technology optimization is further segmented into level of IT implementation, service, responsiveness, cost related performance indicators; resource optimization is further segmented into cost, service, time and financial related performance indicators. These set of indicators include both financial and non-financial measures of performance.

The challenge in measuring the performance is that limited resources used for measurement may as well affect the number and types of indicators developed. It also depends upon the accessibility of information for these indicators. Qualitative data at times, is difficult to be calibrated in to quantitative data. The authors in previous studies believe that there is always a missing factor in development of KPIs, which forces to opt for improved performance indicators. The lack of applicability of these indicators and adopting a holistic approach is one of the main concerns. There have been very limited studies which have focussed on industry specific approach. Further, lack of proper categorization often results in lesser use of performance indicators because the categories often result in no meaning to the industry. Thus an industry specific approach has been adopted such that the interpretation of KPIs on retail supply chain performance can be measured. The managers can prioritize the factors which are important for retail supply chain and can pay more attention to those factors which are more actionable and result oriented in long term, besides managing the day to day operations.

The impact of performance measurement of retail, at large can also be seen on the various dimensions of supply chains which interlink other sectors like growth of transport industry, advancements in IT, inventory management, warehousing. This study makes an effort to overcome these challenges, for quantification of supply chain performance. The theoretical framework suggests a relationship between the identified KPIs and the ROA. Though the framework needs to be further empirically tested and validated through structural equation modeling. This study suggest that broader applicability, a holistic research approach and better categorization of indicators would benefit the organizations in better performance measurement of their supply chains. The model can be validated for organized and unorganized retail in varied geographic regions. The model developed in this study can further be developed by adding some other variables relevant as per the requirement of other industries. Similar studies can be replicated in other developing and developed nations by studying the impact of the identified categories of KPIs on financial performance of the firms.

References

Agarwal, A., Shankar, R. and Tiwari, M.K. (2006), "Modeling the metrics of lean, agile and leagile supply chain: an ANP-based approach", *European Journal of Operational Research*, Vol. 173 No. 1, pp. 211-225.

Akkermans, H., Bogerd, P. and Vos, B. (1999), "Virtuous and vicious cycles on the road towards international supply chain management", *International Journal of Operations & Production Management*, Vol. 19 Nos 5/6, pp. 565-581.

Altiok, T. and Raghav, R. (1995), "Multi-stage, pull-type production/inventory systems", *IIE Transactions*, Vol. 27, pp. 190-200.

Amaratunga, D. and Baldry, D. (2003), "A conceptual framework to measure facilities management performance", *Property Management*, Vol. 21 No. 2, pp. 171-189.

Amaratunga, D., Baldry, D. and Sarshar, M. (2000a), "Assessment of facilities management performance – what next?", *Facilities*, Vol. 18 Nos 1/2, pp. 66-75.

Angerhofer, B.J. and Angelides, M.C. (2006), "A model and a performance measurement system for collaborative supply chains", *Decision Support Systems*, Vol. 42, pp. 283-301.

Aramyan, L.H., Lansink, A.O., Vorst, J. and Kooten, O. (2007), "Performance measurement in agri-food supply chains: a case study", *Supply Chain Management International Journal*, Vol. 12 No. 4, pp. 304-315.

Arntzen, B.C., Gerald, B.G., Terry, H.P. and Linda, T.L. (1995), "Global supply chain management at digital equipment corporation", *INTERFACES*, Vol. 25, pp. 69-93.

Atkin, B. and Brooks, A. (2000), *Total Facilities Management*, Blackwell Science, Oxford.

Augenbroe, G. and Park, C.S. (2005), "Quantification methods of technical building performance", *Building Research and Information*, Vol. 33 No. 2, pp. 159-172.

Aviv, Y. (2007), "On the benefits of collaborative forecasting partnerships between retailers and manufacturers", *Management Science*, Vol. 53 No. 5, pp. 777-794.

Bailey, J.E. and Pearson, S.W. (1983), "Development of a tool for measuring and analyzing computer user satisfaction", *Management Science*, Vol. 29 No. 5, pp. 530-545.

Baldwin, L.H., Camm, F. and Moore, N.Y. (2000), *Strategic Sourcing – Measuring and Managing Performance*, Project Air Force, Research and Development (RAND) Corporation, Santa Monica, CA.

Ballou, R.H., Gilbert, S.M. and Mukherjee, A. (2000), "New managerial challenges from supply chain opportunities", *Industrial Marketing Management*, Vol. 29 No. 1, pp. 7-18.

Barratt, M. and Oliveira, A. (2001), "Exploring the experiences of collaborative planning initiatives", *International Journal of Physical Distribution & Logistics Management*, Vol. 31 No. 4, pp. 266-289.

Beamon, B.M. (1996), "Performance measures in supply chain management", *Proceedings of the Conference on Agile and Intelligent Manufacturing Systems, Troy, NY*.

Beamon, B.M. (1999), "Measuring supply chain performance", *International Journal of Operations & Production Management*, Vol. 19 No. 3, pp. 275-292.

Blumberg, D.R. (1994), "Strategic benchmarking of service and logistic support operations", *Journal of Business Logistics*, Vol. 15 No. 2, pp. 89-119.

Bolstorff, P. (2003), "Measuring the impact of supply chain performance", . *CLO/ Chief Logistics Officers*, Vol. 12, pp. 5-11.

Bourland, K.E., Powell, S.G. and Pyke, D.K. (1996), "Exploiting timely demand information to reduce inventories", *European Journal of Operational Research*, Vol. 44 No. 2, pp. 239-253.

Bower, J.L. and Hout, T.M. (1988), "Fast cycle capability for competitive power", *Harvard Business Review*, November-December, pp. 110-118.

Bowersox, D., Rodrigues, A. and Calantone, R. (2005), "Estimation of global and national logistics expenditures: 2002 data update", *Journal of Business Logistics*, Vol. 26 No. 2, pp. 1-16.

Bowersox, D.J. (1997), "Integrated supply chain management: a strategic imperative", *Annual Conference Proceedings, Council of Logistics Management, Chicago, IL,* pp. 181-189.

Bradley, P., Thomas, J., Gooley, T. and Cooke, J.A. (1999), "Future competition: supply vs supply chain", *Logistics Management & Distribution Report*, Vol. 38 No. 3, pp. 20-21.

Brown, J.R. and Dant, R. (2008), "On what makes a significant contribution to the retailing literature", *Journal of Retailing*, Vol. 84 No. 2, pp. 131-136.

Cachon, G. (2001), "Exact evaluation of batch-ordering policies in two-echelon supply chains with periodic review", *Operations Research*, Vol. 49 No. 1, pp. 79-98.

Cai, J., Liu, X., Xiao, Z. and Liu, J. (2009), "Improving supply chain performance management: a systematic approach to analyzing iterative KPI accomplishment", *Decision Support Systems*, Vol. 46, pp. 612-621.

Chae, B.K. (2009), "Developing key performance indicators for supply chain: an industry perspective", *Supply Chain Management: An International Journal*, Vol. 14 No. 6, pp. 422-428.

Chan, F.T. and Qi, H.J. (2003), "An innovative performance measurement method for supply chain management", *Supply Chain Management: An International Journal*, Vol. 8 No. 3, pp. 209-223.

Chang, T., Fu, H., Lee, W., Lin, Y. and Hsueh, H. (2007), "A study of an augmented CPFR model for the 3C retail industry", *Supply Chain Management: An International Journal*, Vol. 12, pp. 200-209.

Chen, I.J., Paulraj, A. and Lado, A. (2004), "Strategic purchasing, supply management and firm performance", *Journal of Operations Management*, Vol. 22, pp. 505-523.

Chia, A., Goh, M. and Hum, S.H. (2009), "Performance measurement in supply chain entities: balance scorecard perspective", *Benchmarking: An International Journal*, Vol. 16 No. 5, pp. 605-620.

Chopra, S., Meindl, P. and Kalra, D.V. (2007). *Supply Chain Management: Strategy, Planning and Operation*, Pearson Education, New Delhi.

Christensen, C. and Raynor, M. (2003), "Why hard-nosed executives should care about management theory", *Harvard Business Review*, Vol. 81 No. 9, pp. 67-74.

Christopher, M. (1992), *Logistics and Supply Chain Management*, Pitman Publishing, London.

Christopher, M. (1994), *Logistics and Supply Chain Management*, Richard D. Irwin Inc., Financial Times, New York, NY.

Christopher, M. (1998). *Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service*, 2nd ed., Financial Times/Prentice Hall, Harlow, Essex.

Christopher, M. (2005). *Logistics & Supply Chain Management: Creating Value-Adding Networks*, FT/Prentice-Hall, Harlow.

Christy, D.P. and Grout, J.R. (1994), "Safeguarding supply chain relationships", *International Journal of Production Economics*, Vol. 36, pp. 233-242.

Closs, D.J. and Mollenkopf, D.A. (2004), "A global supply chain framework", *Industrial Marketing Management*, Vol. 33, pp. 37-44.

Closs, D.J., Goldsby, T.J. and Clinton, S.R. (1997), "Information technology influences on world class logistics capability", *International Journal of Physical Distribution & Logistics Management*, Vol. 27 No. 1, pp. 4-17.

Cohen, M.A. and Moon, S. (1990), "Impact of production scale economies, manufacturing complexity, and transportation costs on supply chain facility networks", *Journal of Manufacturing and Operations Management*, Vol. 3, pp. 269-292.

Corsten, D. and Gruen, T. (2003), "Seeking on-shelf availability-an examination of the extent, the causes and the efforts to address retail out-of-stocks", *International Journal of Retail and Distribution Management*, Vol. 31 No. 12, pp. 605-716.

Cox, A. (1999a), "A research agenda for supply chain and business management thinking", *Supply Chain Management*, Vol. 4 No. 4, pp. 209-211.

D'Avanzo, R.L., Starr, C.E. and von Lewinski, H. (2004), "Supply chain and the bottom line:a critical link", *Outlook: Accenture*, Vol. 1, pp. 39-45.

Davis, S. and Albright, T. (2004), "An investigation of the effect of balanced scorecard implementation on financial performance", *Management Accounting Research*, Vol. 15, pp. 135-153.

Davis, T. (1993), "Effective supply chain management", *Sloan Management Review*, pp. 35-46.

De Toni, A. and Tonchia, S. (2001), "Performance measurement systems", *International Journal of Operations & Production Management*, Vol. 21 Nos 1/2, pp. 46-70.

Dixon, J.R., Nanni, A.J. and Vollmann, T.E. (1990), *The New Performance Challenge- Measuring Operations for World-class Competition*, Dow Jones-Irwin, Homewood, IL.

Dong, M. and Chen, F.F. (2005), "Performance modeling and analysis of integrated logistic chains: an analytic framework", *European Journal of Operational Research*, Vol. 162, pp. 83-98.

Douglas, J. (1996), "Building performance and its relevance to facilities management", *Facilities*, Vol. 14 Nos 3/4, pp. 23-32.

Dyapur, K.R. and Patnaik, K.K. (2005), "Transaction oriented computing (HIVE computing) using GRAM-soft", *Computational Science*, pp. 879-882.

Ellinger, A.E. and D.P. (2000), "The relationship between marketing/logistics interdepartmental integration and performance in US manufacturing firms: an empirical study", *Journal of Business Logistics*, Vol. 21 No. 2, pp. 1-22.

Ellram, L.M. and Liu, B. (2002), "The financial impact of supply management", *Supply Chain Management Review*, Vol. 6 No. 6, pp. 30-37.

Ellram, L.M., Londe, J.L. and Weber, M.M. (1999), "Retail logistics", *International Journal of Physical Distribution & Logistics Management*, Vol. 29 No. 7/8, pp. 477-494.

Ellram, L.M., Tate, W.L. and Billington, C. (2004), "Understanding and managing the services supply chain", *Journal of Supply Chain Management*, Vol. 40 No. 4, pp. 17-32.

Emmet, S. and Crocker, B. (2006), *The Relationship – Driven Supply Chain*, Gower, Aldershot.

Farris, M.T. II and Hutchison, P.D. (2002), "Cash-to-cash: the new supply chain management metric", *International Journal of Physical Distribution & Logistics Management*, Vol. 32 No. 4, pp. 288-298.

Flynn, B.B. and Flynn, E.J. (2005), "Synergies between supply chain management and quality management: emerging implications", *International Journal of Production Research*, Vol. 43 No. 16, pp. 3421-3436.

Forme, F.G., Genoulaz, V.B. and Campagne, J.P. (2007), "A framework to analyse collaborative performance", *Computers in Industry*, Vol. 58, pp. 687-697.

Forslund, H. and Jonsson, P. (2007), "The impact of forecast information quality on supply chain performance", *International Journal of Operations & Production Management*, Vol. 27, p. 90.

Friscia, T., O'Marah, K. and Souza, J. (2004), *The AMR Research Supply Chain Top 25 and the New Trillion-Dollar Opportunity*, AMR Research Inc., Boston, MA.

Frohlich, M.T. and Westbrook, R. (2001), "Arcs of integration: an international study of supply chain strategies", *Journal of Operations Management*, Vol. 19, pp. 185-200.

Fynes, B. and Voss, C.a. (2005). "The impact of supply chain relationship quality on quality performance", *International Journal of Production Economics*, Vol. 96 No. 3, pp. 339-354.

Ganesan, S., Morris, G., Sandy, J. and Robert, W. (2009), "Supply chain management and retailer performance:emerging trends, issues and implications for research and practice", *Journal of Retailing*, Vol. 85, pp. 84-94.

Gavirneni, S., R.K. and S.T. (1999), "Value of information in capacitated supply chains", *Management Science*, Vol. 45 No. 1, pp. 16-24.

Gelders, L., Mannaert, P. and Maes, J. (1994), "Manufacturing strategy performance indicators and improvement programs", *International Journal of Production Research*, Vol. 32 No. 4, pp. 797-805.

Ginsberg, A. and Venkatraman, N. (1985), "Contingency perspective of organizational strategy: a critical review of the empirical research", *Academy of Management Review*, Vol. 10 No. 3, pp. 421-434.

Globerson, S. (1985), "Issues in developing a performance criteria system for an organisation", *International Journal of Production Research*, Vol. 23 No. 4, pp. 639-646.

Gopal, P.R. and Thakkar, J. (2012), "A review on supply chain performance measures and metrics: 2000-2011", *International Journal of Productivity and Performance Management*, Vol. 61 No. 5, pp. 518-547.

Green, K.W. Jr, Whitten, D. and Inman, R.A. (2008), "The impact of logistics performance on organizational performance in a supply chain context", *Supply Chain Management: An International Journal*, Vol. 13 No. 4, pp. 317-327.

Gumbus, A. (2005), "Introducing the balanced scorecard: creating metrics to measure performance", *Journal of Management Education*, Vol. 29 No. 4, pp. 617-630.

Gunasekaran, A., Patel, C. and Tirtiroglu, E. (2001), "Performance measures and metrics in a supply chain environment", *International Journal of Operations & Production Management*, Vol. 21 No. 1, pp. 71-87.

Gunasekarana, A., Patelb, C. and McGaugheyc, R.E. (2004), "A framework for supply chain performance measurement", *International Journal of Production Economics*, Vol. 84, pp. 333-347.

Gustin, C.M., Daugherty, P.J. and Stank, T.P. (1995), "The effects of information availability on logistics integration", *Journal of Business Logistics*, Vol. 16 No. 1, pp. 1-21.

Hieber, R. (2002). *Supply Chain Management: A Collaborative Performance Measurement Approach*, Verlag der Fachvereine Hochschulverlag AG an der ETH Zurich, Zurich.

Hinks, J. and McNay, P. (1999), "The creation of a management-by-variance tool for facilities management performance assessment", *Facilities*, Vol. 17 Nos 1/2, pp. 31-53.

Hitchcock, R.J. (2002), *High Performance Commercial Building Systems Program, Element 2 – Project 2.1 – Task 2.1.2, Standardized Building Performance Metrics*, Final Report, Building Technology Department, Lawrence Berkeley National Laboratory, Berkeley, CA.

Ho, D., Au, K. and Newton, E. (2002), "Empirical research on supply chain management: a critical review and recommendations", *International Journal of Production Research*, Vol. 40 No. 17, pp. 4415-4430.

Ho, D.C., Chan, W.E., Wong, N. and Chan, M. (2000), "Significant metrics for facilities management benchmarking in the Asia Pacific region", *Facilities*, Vol. 18 Nos 13/14, pp. 545-555.

Hofer, C. (1975), "Towards a contingency theory of business strategy", *Academy of Management Journal*, Vol. 18 No. 4, pp. 784-810.

Hoffman, D. (2004), *The Hierarchy of Supply Chain Metrics: Diagnosing your Supply Chain Health*, AMR Research, Boston, MA.

Huang, S.H., Sheoran, S.K. and Keskar, H. (2005), "Computer-assisted supply chain configuration based on supply chain operations reference (SCOR) model", *Comput Ind Eng*, Vol. 48, pp. 377-394.

Ireland, R.K. and Crum, C. (2005), *Supply Chain Collaboration: How to Implement CPFR and Other Best Collaborative Practices*, J. Ross Publishing Inc., Plantation, FL.

Ishii, K., Takahashi, K. and Muramatsu, R. (1988), "Integrated production, inventory and distribution systems", *International Journal of Production Research*, Vol. 26 No. 3, pp. 473-482.

Johnson, H.T. and Kaplan, R.S. (1987), *Relevance Lost: The Rise and Fall of Management Accounting*, Harvard Business School Press, Boston, MA.

Johnson, J.B. and Randolph, S. (1995), "Brief: making alliances work–using a computer-based management system to integrate the supply chain, JPT", *Journal of Petroleum Technology*, Vol. 47 No. 6, pp. 512-513.

Johnson, M. and Templar, S. (2011), "The relationship between supply chain and firm performance, the development and testing of a unified proxy", *International Journal of Physical Distribution & Logistics Management*, Vol. 41 No. 2, pp. 88-103.

Jones, R.M. and Towill, D.R. (1997), "Information enrichment: designing the supply chain for competitive advantage", *Supply Chain Management: An International Journal*, Vol. 2 No. 4, pp. 137-148.

Kaplan, R.S. and Norton, D.P. (1992), "The balance scorecard- measures that drive performance", *Harvard Business Review*, Vol. 70 No. 1, pp. 71-79.

Keegan, D.P., Eiler, R.G. and Jones, C.R. (1989,), "Are your performance measures obsolete?", *Management Accounting*, Vol. 71, pp. 45-50.

Kim, B. and Oh, H. (2005), "The impact of decision-making sharing between supplier and manufacturer on their collaboration performance", *Supply Chain Management*, Vol. 10 Nos 3/4, pp. 223-236.

Kincaid, D.G. (1994), "Measuring performance in facility management", *Facilities*, Vol. 12 No. 6, pp. 24-27.

KPMG (2011), *Issues Monitor: Sharing Knowledge on Topical Issues in Retail Industry*, Vol 10, KPGM, Amstelveen, July.

Kulp, S.C., Lee, H.L. and Ofek, E. (2004), "Manufacturer benefits from information integration with retail customers", *Management Science*, Vol. 50 No. 4, pp. 431-444.

Lai, K.H., Ngai, E.T. and Cheng, T.E. (2002), "Measures for evaluating supply chain performance in transport logistics", *Transp Res Part E*, Vol. 38, pp. 439-456.

Lalonde, B.J. (2000), "Making finance take notice", *Supply Chain Management Review*, Vol. 4 No. 5, pp. 11-12.

Lambert, D.M. and Cooper, M.C. (2000), "Issues in supply chain management", *Industrial Marketing Management*, Vol. 29 No. 1, pp. 65-83.

Lambert, D.M. and Pohlen, T.L. (2001), "Supply chain metrics", *The International Journal of Logistics Management*, Vol. 12 No. 1, pp. 1-19.

Lapide, L. (2000), "What about measuring supply chain performance?", *ASCET*, Vol. 2 No. 15, pp. 287-297.

Lavy, S., Garcia, J.A. and Dixit, M.K. (2010), "Establishment of KPIs for facility performance measurement: review of literature", *Facilities*, Vol. 28 No. 9, pp. 440-464.

Lawrence, P.R. and Lorsch, W.J. (1967), "Differentiation and integration in complex organization", *Administration*, pp. 1-47.

Lebas, M.J. (1995), "Performance measurement and performance management", *Int. J. Product. Econ.*, Vol. 41 Nos 1-3, pp. 23-35.

Lee, H.L. (2004), "The triple-a supply chain", *Harvard Business Review*, Vol. 82 No. 10, pp. 102-113.

Lee, H.L. and Billington, C. (1993), "Material management in decentralized supply chains", *Operations Research*, Vol. 41 No. 5, pp. 835-847.

Lee, H.L. and Feitzinger, E. (1995), "Product configuration and postponement for supply chain efficiency", *Institute of Industrial Engineers, Fourth Industrial Engineering Research Conference Proceedings*, pp. 43-48.

Lee, H.L., Padmanabhan, V. and Whang, S. (1997), "The bullwhip effect in supply chains", *Sloan Management Review*, Vol. 38 No. 3, pp. 93-102.

Li, D. and O'Brien, C. (1999), "Integrated decision modelling of supply chain efficiency", *International Journal of Production Economics*, Vol. 59 Nos 1-3, pp. 147-157.

Li, S., Ragu-Nathanb, B., Ragu-Nathanb, T.S. and Rao, S.S. (2006), "The impact of supply chain management practices on competitive advantage and organizational performance", *Omega International Journal of Management Science*, Vol. 34 No. 2, pp. 107-124.

Lin, C. (2006), "Influencing factors on the innovation in logistics technologies for logistics service providers in Taiwan", *The Journal of American Academy of Business*, Vol. 9 No. 2, pp. 257-263.

Lockamy, A. III and McCormack, K. (2004), "Linking SCOR planning practices to supply chain performance: an exploratory study", *International Journal of Operations & Production Management*, Vol. 24 Nos 11/12, pp. 1192-1218.

McCarthy, T.M. and Golicic, S.L. (2002), "Implementing collaborative forecasting to improve supply chain performance", *International Journal of Physical Distribution & Logistics Management*, Vol. 32 No. 6, pp. 431-454.

Mapes, J., New, C. and Szwejczewski, M. (1997), "Performance trade-offs in manufacturing plants", *International Journal of Operations & Production Management*, Vol. 17 No. 10, pp. 1020-1033.

Maskell, B. (1991), *Performance Measurement for World Class Manufacturing: A Model for American Companies*, Productivity Press, Cambridge, MA.

Morgan, C. (2004), "Structure, speed and salience: performance measurement in the supply chain", *Business Process Management Journal*, Vol. 10 No. 5, pp. 522-536.

Moseng, B. (1995), *Productivity Measurement: Methods And Tools Developed in TOPP: Benchmarking Theory and Practice*, Chapman&Hall, London.

Neely, A., Bourne, M. and Kennerley, M. (1995), "Performance measurement system design: developing and testingaprocess-based approach", *International Journal of Operations & Production Management*, Vol. 20 No. 10, pp. 1119-1145.

Neely, A.D. (1999), The performance measurement revolution: why now and where next?", *International Journal of Operations and Production Management*, Vol. 19 No. 2, pp. 205-228.

Newhart, D.D., Stott, K.L. and Vasko, F.J. (1993), "Consolidating product sizes to minimize inventory levels for a multi-stage production and distribution systems", *Journal of the Operational Research Society*, Vol. 44 No. 7, pp. 637-644.

Nicoll, A.D. (1994), "Integrating logistics strategies", *Annual International Conference Proceedings – American Production and Inventory Control Society*, pp. 590-594.

O'Sullivan, D.T., Keane, M.M., Kelliher, D. and Hitchcock, R.J. (2004), "Improving building operation by tracking performance metrics throughout the building lifecycle (BLC)", *Energy and Buildings*, Vol. 36 No. 11, pp. 1075-1090.

Prahalad, C.K. and Hamel, G. (1990), "The core competence of the corporation", *Harvard Business Review*, Vol. 68 No. 3, pp. 79-91.

Prahalad, C.K. and Krishnan, M.S. (2008), *The New Age of Innovation: Driving Co-Created Value Through Global Networks*, McGraw Hill, NewYork, NY.

Pyke, D.F. and Cohen, M.A. (1993), "Performance characteristics of stochastic integrated production-distribution systems", *European Journal of Operational Research*, Vol. 68 No. 1, pp. 23-48.

Pyke, D.F. and Cohen, M.A. (1994), "Multi-product integrated production distribution systems", *European Journal of Operational Research*, Vol. 74 No. 1, pp. 18-49.

Raghunathan, S. (2001), "Information sharing in a supply chain: a note on its value when demand is non stationary", *Management Science*, Vol. 47 No. 4, pp. 605-610.

Rahman, S. (1998), "Theory of constraints- a review of the philosophy and its application", *International Journal of Operations and Production Management*, Vol. 18 No. 4, pp. 336-355.

Rajaguru, R. and Matanda, M.J. (2009), "Influence of inter-organisational integration on business performance: the mediating role of organisational-level supply chain functions", *Journal of Enterprise Information Management*, Vol. 22 No. 4, pp. 456-467.

Raman, A., DeHoratius, N. and Ton, Z. (2001a), "The achilles heel of supply chain management", *Harvard Business Review*, pp. 136-152.

Ramdas, k. and Spekman, R.E. (2000), "Chain or shackles: understanding what drives supply-chain performance", *Interfaces*, Vol. 30 No. 4, pp. 3-21.

Ramesh, A., Banwet, D.K. and Shankar, R. (2008), "Modeling the enablers of supply chain collaboration", *International Journal of Logistics Systems and Management*, pp. 373-383.

Rosenzweig, E.D., Roth, A.V. and Dean, J.W. (2003), "The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers", *Journal of Operations Management*, Vol. 21 No. 4, pp. 437-456.

Rowat, C. (2006), "Collaboration for improved product availability", *Logistics and Transport Focus*, Vol. 8 No. 3, pp. 18-20.

Rungtusanatham, M., Salvador, F., Forza, C. and Choi, T.Y. (2003), "Supply-chain linkages and operational performance: a resource-based-view perspective", *International Journal of Operations & Production Management*, Vol. 23 No. 9, pp. 1084-1099.

Sambasivan, M., Mohamed, Z.A. and Nandan, T. (2009) "Performance measures and metrics for e-supply chains", *Journal of Enterprise Information Management*, Vol. 22 No. 3, pp. 346-360.

Schefcyzk, M. (1993), "Industrial benchmarking: a case study of performance analysis techniques", *International Journal of Production Economics*, Vol. 32 No. 1, pp. 1-11.

Schonberger, R.J. (1990), *Building a Chain of Customers*, The Free Press, London.

Schoonhoven, C. (1981), "Problems with contingency theory: testing assumptions hidden within the language of contingency theory", *Administrative Science Quarterly*, Vol. 26, pp. 349-377.

Shah, J. (2009), *Supply Chain Management*, Pearson Education, Delhi.

Shahin, A. and Mahbod, M.A. (2007), "Prioritization of key performance indicators. An integration of analythical hierarchy process and goal setting", *International Journal of Productivity and Performance Management*, Vol. 56 No. 3, pp. 226-240.

Shepherd, C. and Gunter, H. (2006), "Measuring supply chain performance: current research and future directions", *International journal of Productivity and Performance Measurement*, Vol. 55 Nos 3/4, pp. 242-258.

Simatupang, T.M. and Sridharan, R. (2004), "A benchmarking scheme for supply chain collaboration", *Benchmarking: An International Journal*, Vol. 11 No. 1, pp. 9-29.

Simchi-Levi, D. and Zhao, Y. (2005), "Safety stock positioning in supply chains with stochastic lead times", *Manufacturing & Service Operations Management*, Vol. 7, pp. 295-318.

Slack, N., Chambersm, S., Harland, C., Harrison, A. and Johnston, R. (1995), *Operations Management*, Pitman Publishing, London.

Soni, G. and Kodali, R. (2009), "Performance value analysis for the justification of the leagile supply chain", *International Journal of Business Performance Management*, Vol. 11 Nos 1/2, pp. 96-133.

Sousa, S.D., Aspinwall, E.M. and Rodrigues, A.G. (2006), "Performance measures in english small and medium enterprises: survey results", *Benchmarking: An International Journal*, Vol. 13 Nos 1/2, pp. 120-134.

Stank, T.P., Davis, B.R. and Fugate, B.S. (2005), "A strategic framework for supply chain oriented logistics", *Journal of Business Logistics*, Vol. 26 No. 2, pp. 27-45.

Stewart, G. (1995), "Supply chain performance benchmarking study reveals keys to supply chain excellence", *Logistics Information Management*, Vol. 8 No. 2, pp. 38-44.

Swanson, E.B. (1982), "Measuring user attitudes in MIS research: a review", *OMEGA*, Vol. 10 No. 2, pp. 157-165.

Talluri, S. and Sarkis, J. (2001), "A computational geometry approach for benchmarking", *International Journal of Operations & Production Management*, Vol. 21 No. 1, pp. 210-222.

Taticchi, P., Tonelli, F. and Cagnazzo, L. (2010), "Performance measurement and management: a literature review and a research agenda", *Measuring Business Excellence*, Vol. 14 No. 1, pp. 4-18.

Towers, N. and Burnes, B. (2008), "A composite framework of supply chain management and enterprise planning for small and medium-sized manufacturing enterprises", *Supply Chain Management: An International Journal*, Vol. 13 No. 5, pp. 349-355.

Van der Vorst, J.A. (2000), "Effective food supply chains generating, modelling and evaluating supply chain scenarios", PhD thesis, Wageningen University, Wageningen.

Van Donk, P. and Van der Vaart, T. (2005), "A critical discussion on the theoretical and methodological advancements in supply chain integration research", in Kotzab, H., Seuring, S., Müller, M. and Reiner, G. (Eds), *Research Methodologies in Supply Chain Management*, H. Physica-Verlag, pp. 31-46.

Voudouris, V.T. (1996), "Mathematical programming techniques to debottleneck the supply chain of fine chemical industries", *Computers and Chemical Engineering*, Vol. 20, pp. S1269-S1274.

Walters, P.G. (2008), "Adding value in global B2B supply chains: strategic directions and the role of the internet as a driver of competitive advantage", *Industrial Marketing Management*, Vol. 37 No. 1, pp. 59-68.

Whipple, J.M., Frankel, R. and Daugherty, P.J. (2002), "Information support for alliances: performance implications", *Journal of Business Logistics*, Vol. 23 No. 2, pp. 67-82.

Yang, C.C. and Chen, B.S. (2006), "Supplier selection using combined analytical hierarchy process and grey relational analysis", *Journal of Manufacturing Technology*, pp. 926-941.

Further reading

Barratt, M. and Oke, A. (2007), "Antecedents of supply chain visibility in retail supply chain: a resource-based theory perspective", *Journal of Operations Management*, Vol. 25, pp. 1217-1233.

Beierlein, J.G. and Miller, C.A. (2000), *Performance Measures, and Measurement in Supply Chains in the Food System*, Pennsylvania State University, World Food & Agribusiness Forum, Chicago, June 25.

Bernon, M., Rossi, S. and Cullen, J. (2011), "Retail reverse logistics: a call and grounding framework", *International Journal of Physical Distribution & Logistics Management*, Vol. 41 No. 5, pp. 484-510.

Chavez, R., Brian, F., Gimenez, C. and Wiengarten, F. (2012), "Assessing the effect of Industry clockspeed on the supply chain management practice- performance relationship", *Supply Chain Management: An International Journal*, Vol. 17 No. 3, pp. 290-305.

Churchill, G. (1979), "A paradign for developing better measures of marketing constructs", *Journal of Marketing Research*, Vol. 12 No. 2, pp. 64-73.

Editorial (2010), "Modeling retail phenomena", *Journal of Retailing*, Vol. 86 No. 2, pp. 117-124.

Forker, L.B., Mendex, D. and Hershauer, J.C. (1997), "Total quality management in the supply chain: what is its impact on performance?", *International journal of Production Research*, Vol. 35 No. 6, pp. 1681-1701.

Ganesan, S., George, M., Jap, S., Palmatier, R.W. and Weitz, B. (2009), "Supply chain management and retailer performance: emerging trends, issues, and implications for research and practice", *Journal of Retailing*, Vol. 85 No. 1, pp. 84-94.

Gomez, I.M., McLaughlin, E.W. and Wittink, D.R. (2004), "Customer satisfaction and retail sales performance: an empirical investigation", *Journal of Retailing*, Vol. 80, pp. 265-278.

Gregory, M.J. (1993), "Integrated performance measurement: a review of current practice and emerging trends", *International Journal of Production Economics* , Vol. 30 No. 31, pp. 281-296.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998), *Multivariate Data Analysis*, Prentice-Hall, Englewood Cliffs, NJ.

Hamister, J.W. (2012), "Supply chain management practices in small retailers", *International Journal of Retail & Distribution Management*, Vol. 40 No. 6, pp. 427-450.

Hofer, C., Jin, H., Swanson, R.D., Matthew, W.A. and Williams, B.D. (2012), "The impact of key retail accounts on supplier performance: a collaborative perspective of resource dependency theory", *Journal of Retailing*.

Hsiao, J.-M.M. (October 2006), *The Impact of Retailer-Supplier Cooperation and Decision-Making Uncertainty on Supply Chain Performance*, Institute of Transport and Logistics Studies, Faculty of Economics and Business, The University of Sydney.

Jakate, D. (2007), "Retail supply chain", *The 2007 BPC World Conference Proceedings*, *Mumbai*, pp. 2-17.

Khan, K. and shah, A. (2011), "Understanding performance measurement through the literature", *African Journal of Business Management*, Vol. 35 No. 5, pp. 13410-13418.

Lee, H.L. (2000) "Creating value through supply chain integration", *Supply Chain Management Review*, Vol. 4 No. 4, pp. 30-36.

Lewis, A.T. (2006). *The Effects of Information Sharing, Organizational Capability and Relationship Characteristics on Outsourcing Performance in the Supply Chain: An Empirical Study*, The Ohio State University, Columbus, OH.

Lindner, C. (2009), *Suppl y Chain Per formance Measurement, A Research of Occurring Problems and Challenges*, Jönköping University, Jönköping.

Moberg, C.R., Whipple, T.W., Cutler, B.D. and Speh, T.W. (2004), "Do the management components of supply chain management affect logistics performance?", *The International Journal of Logistics Management*, Vol. 15 No. 2, pp. 15-30.

Nunnally, J. (1979), *Psychometric Theory*, Mc-Graw-Hill, London.

Oh, L.-B., Teo, H.-H. and Sambamurthy, V. (2012), "The effects of retail channel integration through the use of information technologies on firm performance", *Journal of Operations Management*, Vol. 30, pp. 368-381.

Ou, C.S., Liu, F.C., Hung, Y.C. and Yen, C.D. (2010), "A structural model of supply chain management on firm performance", *International Journal of Operations & Production Management*, Vol. 30 No. 5, pp. 526-545.

Rao, B.P. (2000), "Mproving retail effectiveness through technology: a survey of analytical tools for physical and on-line retailers", *Technology in Society*, Vol. 22, pp. 111-122.

Robinson, J.P., Shaver, P.R. and Wrightsman, L.S. (Eds) (1991), "Criteria for scale selection and evaluation", *Measures of Personality and Social Psychological Attitudes*, Vol. 1, Academic Press, San Diego, CA, pp. 1-16.

Shaw, S. and Grant, D.B. (2012), "Developing environmental supply chain performance measures", *Benchmarking: An International Journal*, Vol. 17 No. 3, pp. 320-339.

Watch, E. (2010a), "Conclusion on retail industry in India", June 30, available at: www.economywatch.com/business-and-economy/conclusion.html (accessed June 4, 2012).

Watch, E. (2010b), "Indian retail industry", June 30, available at: www.economywatch.com/business-and-economy/indian-retail-industry.html (accessed June 4, 2012).

Watch, E. (2010c), "Size of indian retail industry and present scenario", June 30, available at: www.economywatch.com/business-and-economy/indian-retail-industry-size.html (accessed June 4, 2012).

Watch, E. (2010d), "Top companies in the Indian retail industry", June 30, available at: www.economywatch.com/business-and-economy/top-companies-india-retail-industry.html (accessed June 4, 2012).

Whitten, G.D., Green, W.K. Jr and Zelbst, P.J. (2012), "Triple-a supply chain performance", *International Journal of Operations & Production Management*, Vol. 32 No. 1, pp. 28-48.

Corresponding author
Neha Grover can be contacted at: neha.grover10@gmail.com